

Topic: Multiplying and dividing scientific notation**Question:** Rewrite the expression in scientific notation.

$$\frac{(60 \times 10^7) (200 \times 10^{-2})}{(1,000 \times 10^{-5})}$$

Answer choices:

- A 12×10^{11}
- B 1.2×10^{-10}
- C 1.2×10^{11}
- D 1.2×10^{10}



Solution: C

We'll begin by doing the multiplication in the numerator, so we'll multiply the decimal numbers and the powers of 10 separately, remembering that we have to add the exponents.

$$\frac{(60 \times 10^7) (200 \times 10^{-2})}{(1,000 \times 10^{-5})}$$

$$\frac{(60 \times 200) (10^7 \times 10^{-2})}{(1,000 \times 10^{-5})}$$

$$\frac{12,000 \times 10^{7+(-2)}}{(1,000 \times 10^{-5})}$$

$$\frac{12,000 \times 10^{7-2}}{(1,000 \times 10^{-5})}$$

$$\frac{12,000 \times 10^5}{1,000 \times 10^{-5}}$$

The result we got for that multiplication ($12,000 \times 10^5$) isn't in proper scientific notation, but we'll go ahead and do the division, and then at the end we'll make any adjustments that are needed to express the answer in proper scientific notation.

Dividing the decimal numbers, we get

$$12,000 \div 1,000 = 12$$

Dividing the powers of 10, remembering to subtract the exponents:



$$10^5 \div 10^{-5} = 10^{5-(-5)} = 10^{5+5} = 10^{10}$$

Multiplying the results of those two divisions, we get

$$12 \times 10^{10}$$

This still isn't in proper scientific notation, because there are two digits to the left of the place where the decimal point would be in 12. We first put a decimal point after the 12 (giving 12.), and then we move the decimal point one place to the left, so the exponent will be 1.

$$12 = 1.2 \times 10^1$$

Now we'll multiply 1.2×10^1 by 10^{10} , adding the exponents.

$$(1.2 \times 10^1) \times 10^{10}$$

$$1.2 \times (10^1 \times 10^{10})$$

$$1.2 \times 10^{1+10}$$

$$1.2 \times 10^{11}$$



Topic: Multiplying and dividing scientific notation**Question:** Rewrite the expression in scientific notation.

$$\frac{(2.7 \times 10^3) (3 \times 10^{-5})}{(60 \times 10^{-2}) (20 \times 10^5)}$$

Answer choices:

- A 10×5.2
- B 8.1×10^{-2}
- C 5.75×10^{-7}
- D 6.75×10^{-8}



Solution: D

We'll first do the multiplication in the numerator and the multiplication in the denominator. In each of those multiplications, we'll multiply the decimal numbers and the powers of 10 separately, remembering that we have to add the exponents when we multiply powers of 10.

$$\frac{(2.7 \times 10^3) (3 \times 10^{-5})}{(60 \times 10^{-2}) (20 \times 10^5)}$$

$$\frac{(2.7 \times 3) (10^3 \times 10^{-5})}{(60 \times 20) (10^{-2} \times 10^5)}$$

$$\frac{8.1 \times 10^{3+(-5)}}{1,200 \times 10^{-2+5}}$$

$$\frac{8.1 \times 10^{3-5}}{1,200 \times 10^{-2+5}}$$

$$\frac{8.1 \times 10^{-2}}{1,200 \times 10^3}$$

The denominator isn't in proper scientific notation, because there are four digits to the left of the place where the decimal point would be in 1,200. However, we'll go ahead and do the division, and wait until the end to make any adjustments that are needed to get the answer in proper scientific notation.

Our next step will be to divide the decimal numbers and the powers of 10 separately, remembering to subtract the exponents.



$$8.1 \div 1,200 = 0.00675$$

$$10^{-2} \div 10^3 = 10^{-2-3} = 10^{-5}$$

Multiplying the results of those two divisions, we get

$$0.00675 \times 10^{-5}$$

This isn't in proper scientific notation, because the digit to the left of the decimal point in 0.00675 is 0, so now we'll convert 0.00675 to proper scientific notation.

In order to get exactly one nonzero digit to the left of the decimal point, we need to move the decimal point 3 places to the right, so the exponent will be -3 .

$$0.00675 = 6.75 \times 10^{-3}$$

Finally, we'll multiply 6.75×10^{-3} by 10^{-5} , adding the exponents.

$$(6.75 \times 10^{-3}) \times 10^{-5}$$

$$6.75 \times (10^{-3} \times 10^{-5})$$

$$6.75 \times 10^{-3+(-5)}$$

$$6.75 \times 10^{-3-5}$$

$$6.75 \times 10^{-8}$$



Topic: Multiplying and dividing scientific notation**Question:** Rewrite the expression in scientific notation.

$$\frac{(40,000 \times 10^5) (120 \times 10^{-20})}{(0.003 \times 10^{-8}) (2,000)}$$

Answer choices:

- A 80×10^2
- B $(40 \times 20) (10^2)$
- C 0.8×10^{-2}
- D 8.0×10^{-2}



Solution: D

In the numerator and denominator, we'll multiply the decimal numbers together, and then separately multiply the powers of 10, remembering that we have to add the exponents.

$$\frac{(40,000 \times 10^5) (120 \times 10^{-20})}{(0.003 \times 10^{-8}) (2,000)}$$

$$\frac{(40,000 \times 120) (10^5 \times 10^{-20})}{(0.003 \times 2,000) (10^{-8})}$$

$$\frac{4,800,000 \times 10^{5+(-20)}}{6 \times 10^{-8}}$$

$$\frac{4,800,000 \times 10^{5-20}}{6 \times 10^{-8}}$$

$$\frac{4,800,000 \times 10^{-15}}{6 \times 10^{-8}}$$

$$\frac{4,800,000}{6} \times \frac{10^{-15}}{10^{-8}}$$

$$800,000 \times 10^{-15-(-8)}$$

$$800,000 \times 10^{-15+8}$$

$$800,000 \times 10^{-7}$$

In order to write this in scientific notation, we have to express 800,000 as only one digit in the ones (units) place, and one digit in the tenths place. We need to think of 800,000 as 800,000.0 in order to realize that we need to



move the decimal five places to the left in order to get 8.0. So we'll change the expression to

$$8.0 \times 10^5 \times 10^{-7}$$

$$8.0 \times 10^{5+(-7)}$$

$$8.0 \times 10^{5-7}$$

$$8.0 \times 10^{-2}$$

